Carbonate diagenesis in the Pacific Equatorial Age Transect (PEAT) Sites and the preservation of geochemical signals in foraminifera

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The calcite shells (tests) of foraminifera used for reconstructions of oceanic and climatic conditions in the past can be altered after deposition by a process where the original biogenic calcite is replaced by secondary (inorganic) calcite. It is important to quantify changes in the elemental and isotopic composition of the tests caused by this recrystallisation process and thus the reliability of the proxy data. We present initial results from a multi-component study of recrystallisation in sediments from the IODP Expedition 320/321 Pacific Equatorial Age Transect (PEAT), where sediments of similar age and initial composition have been subjected to different diagenetic histories.

$^{87}Sr/^{86}Sr$ ratios of bulk carbonate leachates and the associated pore waters generally suggest that recrystallisation occurred relatively rapidly as the values are indistinguishable (within 2σ uncertainties) from contemporaneous seawater [1]. Notable exceptions include Site U1336, where pore waters and the bulk carbonates in sediments older than 20.3 Ma have lower $^{87}Sr/^{86}Sr$ ratios than contemporaneous seawater, most likely resulting from the upward diffusion of Sr from older recrystallised carbonates.

Furthermore, the lower Sr/Ca ratios of bulk carbonates from Site U1336, compared to the other PEAT sites, suggest more extensive diagenetic alteration as less Sr is incorporated into secondary calcite. Although the recrystallisation of bulk carbonates is well documented, the fate of foraminiferal chemistry is potentially different. To investigate this, laser ablation ICP-MS element/Ca ratio depth profiles through tests of the planktonic foraminifera *G. venezuelana* from Sites U1336 and U1338 were obtained for two time intervals (13.9 Ma and 15.5 Ma). The depth profiling technique reveals heterogeneity of Mg/Ca and Mn/Ca ratios through the wall of the tests comparable to those reported for modern foraminifera from sediment traps [2]. The Sr/Ca ratios show little heterogeneity and fluctuate around 1.1-1.2 mmol/mol as also observed for modern tests. The Sr/Ca ratios exhibit no systematic difference between the sites and time intervals. Therefore, the intra-test element/Ca heterogeneity suggests that foraminifera react differently to bulk carbonates (nanno-fossils) during diagenetic recrystallisation and much of the original geochemical proxy signal may have been retained.

[1] McArthur *et al.* (2001) *The Journal of Geology* **109**, 155-170
[2] Hathorne *et al.* (2009) *Paleoceanography* **24**, PA4204